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NAVAL POSTGRADUATE SCHOOL

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ONE SIZE DOES NOT FIT ALL: PERSONALIZED INCENTIVES IN MILITARY COMPENSATION

by

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A critical element in implementing a compensation scheme including non-monetary incentives (NMIs) is recognizing that preferences vary widely across service members. There are at least three sources of variability: variability across population classes (e.g., preferences vary across Services, professional communities, rank/pay grade, etc.); variability across individuals within a population class (e.g., preferences vary across people in similar circumstances); and variability across NMI packages for a particular individual (e.g., values for an individual NMI may depend on the package of NMIs offered).
Surveys across different military communities, ranks, and years of service, show the difficulty of identifying any NMI that has significant value for even 50% of the active duty force. At the same time, approximately 80% of the surveyed service members expressed a significant positive value for at least one NMI. As a result, one-size-fits-all incentive packages will not be nearly as effective as more individually tailored incentive packages. This paper discusses variability in service member NMI preferences and outlines an approach to implementing personalized NMI packages in military compensation through a sealed-bid reverse auction, where service members select individual NMIs from a "cafeteria-style" menu of options.

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ABSTRACT

A critical element in implementing a compensation scheme including non-monetary incentives (NMIs) is recognizing that preferences vary widely across service members. There are at least three sources of variability: variability across population classes (e.g., preferences vary across Services, professional communities, rank/pay grade, etc.); variability across individuals within a population class (e.g., preferences vary across people in similar circumstances); and variability across NMI packages for a particular individual (e.g., values for an individual NMI may depend on the package of NMIs offered).

Surveys across different military communities, ranks, and years of service, show the difficulty of identifying any NMI that has significant value for even 50% of the active duty force. At the same time, approximately 80% of the surveyed service members expressed a significant positive value for at least one NMI. As a result, one-size-fits-all incentive packages will not be nearly as effective as more individually tailored incentive packages. This paper discusses variability in service member NMI preferences and outlines an approach to implementing personalized NMI packages in military compensation through a sealed-bid reverse auction, where service members select individual NMIs from a "cafeteria-style" menu of options.

Keywords: Military Compensation, Non-Monetary Incentives, Survey

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I. INTRODUCTION

The Department of Defense (DoD) is facing an austere and uncertain future budget environment. According to Harrison (2011) fiscal year (FY) 2012 defense funding falls to $525 billion under the Budget Control Act of 2011, compared to FY 2011 funding of $530 billion and the president's FY 2012 request of $553 billion; the Office of Management and Budget projects a 10-year reduction in defense spending totaling $330 billion from the previous baseline levels. The automatic budget cuts triggered when the Joint Committee on Deficit Reduction failed to reach agreement could reduce the FY 2013 defense budget to $472 billion, its FY 2007 level, compared to the FY 2013 baseline of $549 billion and the president's projection of $571 billion (Harrison, 2011). Pay and benefits for military personnel accounted for $181 billion in the FY 2012 budget request, approximately one third of the president's defense budget request; the per person cost of military personnel has grown by 46% over the last 10 years (Harrison & Montgomery, 2011). Due to its absolute size and relative recent growth, military compensation is a reasonable area to look for savings in defense expenditures. However, there is concern about reducing service members' satisfaction with their total compensation given the all-volunteer force and the increases in operational tempo and deployments during the recent confrontations.

How best to modify military compensation is a complex question, because military compensation involves a complicated mix of base pay and allowances, special and incentive pay, non-monetary incentives, and deferred compensation. According to the DoD (2012), active duty cash compensation accounts for approximately 51% of military compensation, with 21% coming from non-cash benefits, and 28% coming from deferred compensation. Table 1 provides specific details.

Table 1. Components of Military Compensation: Cash, Non-Cash and Deferred

Cash		**Non-Cash**		**Deferred**	
Basic Pay	30.0%	Health Care	8.5%	Retired Pay Accrual	9.5%
Housing Allowances	10.8%	Housing	0.8%	Health Care Accrual	10.2%
Subsistence Allowance	2.5%	Education	0.4%	Veterans Benefits	8.5%
Other Allowances	3.3%	Other Non-Cash	10.8%		
Special & Incentive Pays	5.6%				
Tax Advantages	2.8%				
Other Cash	0.6%				
Total	51.4%		20.5%		28.1%

Note. This information comes from the DoD (2012, p.17).

Offering non-monetary incentives in addition to cash compensateion allows the DoD to provide greater service-member benefit at a lower cost as a result of two primary efficiencies: (1) service-member value for a non-monetary incentive may exceed the cost of provision; and (2) service-member benefit from cash compensation is subject to diminishing marginal satisfaction from money.

When the DoD's cost to provide a non-monetary incentive is less than the service member's value, both parties can potentially benefit. Employer-provided healthcare is one example where economies of scale (and corporate tax deductions for private sector firms) make premiums for employer-provided health care less costly than individual insurance premiums. The military Services offer a host of such non-monetary incentives, including health care, education, and housing (see Table 1). But the DoD could further exploit other potentially valuable non-monetary incentives, including assignment preferences, geographic stability, telecommuting and condensed workweek opportunities (where operationally feasible), and other quality-of-life programs (e.g., child care, commissaries, etc.), and so forth.

In addition, the value service members receive from an additional dollar of income decreases as income increases (i.e., diminishing marginal satisfaction from income). After a point, non-cash incentives may have a greater impact than additional cash payments. This may be particularly true for some special and incentives pay, including selective retention bonuses. For example, retention rates for junior surface warfare officers (SWOs) have remained problematic despite large increases in retention bonuses, currently totaling $75,000, indicating that non-monetary incentives may offer a cost-effective alternative (Denmond, Johnson, Lewis, & Zegley, 2007).

A critical element in implementing a compensation scheme including non-monetary incentives is recognizing that preferences vary widely over different employees (for example, service members when discussing military compensation). As a result, one-size-fits-all incentive packages won't be nearly as effective as more individually tailored incentive packages. Harrison and Montgomery (2011) emphasized that military compensation reform should not simply focus on reducing costs, but rather on increasing the value service members receive from their compensation package. They recommended a scheme referred to as preference-based incentives optimization. Under this scheme, the pertinent issue for every compensation element is to ensure that service members receive a value that is at least commensurate with the DoD's cost to provide the incentive.

Preference-based incentives optimization discourages one-size-fits-all schemes in favor of personalized compensation packages that emphasize the service members' unique preferences. Harrison and Montgomery (20011, p. 3) referenced examples of private sector companies who have captured significant cost savings, without reducing their employees' perceived compensation value. Personalized incentive packages are becoming increasingly popular in the private sector. Hattiangadi (2001) noted, "Nearly 80 percent of surveyed workers say that incentives are very important in their decision to accept or reject a job" (p. 8). According to the Bureau of Labor and Statistics, the percentage of employees in medium and large companies with access to flexible incentives increased from 5% in 1988 to 13% in 1999 (General Accounting Office [GAO], 2002, p. 57). By 2006, that number had risen to 28% of companies that employ 100 or more people (TED, 2007).[1]

[1] For further discussion of private sector initiatives, see Coughlan, Gates, and Zimmerman (2011, pp. 21–32).

This is particularly relevant for military service members, where over 50% of military compensation is deferred or non-cash. It is also consistent with the two major themes developed in the Tenth Quadrennial Review of Military Compensation (DoD, 2008a; DoD, 2008b). As emphasized there, the compensation system needs to be flexible to respond to changing operational demands and the unique circumstances of different operational communities or pay grades. The report also emphasized that it is equally important to offer individual service members greater choice, as long as that choice is consistent with operational demands.

We explore non-monetary incentives in military compensation. In particular, we will examine one-size-fits-all versus personalized non-monetary incentive packages. To date, most non-monetary incentives in military compensation are offered universally to all service members. This squanders much of the potential value of non-monetary incentives and may actually increase the DoD's costs over a purely cash payment system. To paraphrase the comment of then Chief of Naval Personnel (CNP), VADM Mark E. Ferguson (2008), at the 2008 Navy Workforce Research and Analysis Conference, Why are we giving childcare incentives to an 18-year-old single sailor with no dependents? By allowing service members to choose only those incentives they value more than the cost to provide, the DoD can eliminate the waste associated with unwanted or undervalued incentives, while empowering service members to have a voice in determining the compensation packages they receive.

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II. COST-EFFECTIVENESS AND NON-MONETARY INCENTIVES

The potential cost savings from non-monetary incentives arise when service members value an incentive more than what it costs the DoD to provide. Recognizing that service members have different values for any particular non-monetary incentive (NMI), we can depict the demand for an NMI as downward sloping; those NMIs with the highest values make up the higher portion of the curve, and those with lower values, the lower portion of the curve. Assuming the marginal cost to provide an NMI is constant,[2] the demand and supply for an NMI can be represented as in Figure 1.

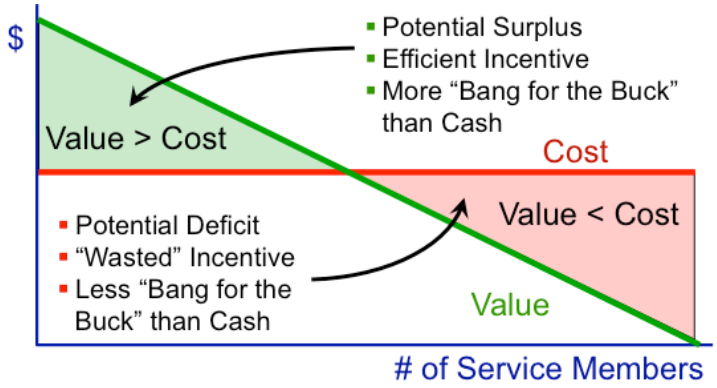

Figure 1. Cost Versus Value of Non-Monetary Incentives

It is cost effective for the DoD to provide an NMI to those service members for whom the value of the NMI exceeds its cost. These are the service members in the upper left of Figure 1, where the demand curve is above the cost to provide the NMI. The upper left area between the service members' NMI demand curve and the DoD's NMI cost curve, labeled "Value > Cost," represents the "surplus value" associated with an NMI. This area is value that service members receive from the NMI in excess of the DoD's cost to provide the NMI. If the DoD offers these service members this NMI and reduces their cash compensation by their NMI value, it would leave the service members as well off as with the cash payment, but reduce the DoD's total compensation cost. Alternatively, the DoD could reduce the service members' cash compensation by an amount equal to the cost of providing the NMI, leaving the DoD's total compensation cost the same but increasing the service members' value. Offering an NMI to service members where the value exceeds the DoD's costs can reduce the DoD's compensation costs, increase the service members' compensation value, or do both.

However, the NMI should not be offered to those service members for whom the cost to provide the NMI exceeds the value to the service member. These are the service members in the lower right of Figure 1. The lower right area between the DoD's NMI cost curve and the service members' NMI demand curve, labeled "Cost > Value," represents the

[2] The constant marginal cost assumption can be easily relaxed. It is offered here, with no loss of generality, to simplify the graphical representation.

amount by which the DoD's costs exceed the value the service members receive. The DoD could not reduce cash compensation to these service members by an amount equal to the DoD's cost to provide the NMI without reducing the service members' compensation value. Offering an NMI to service members that has a value below cost will either raise the DoD's compensation costs, lower the service members' value, or do both.

This clearly raises an important question regarding non-monetary compensation incentives: What NMIs should be offered and to whom should they be offered?

A. THE UNIVERSAL INCENTIVE PACKAGE (UIP)

The simplest way to incorporate non-monetary incentives is to offer a "one-size-fits-all," or universal, incentive package that combines a predetermined portfolio of NMIs coupled with cash compensation. To reduce the DoD's compensation costs compared with purely cash compensation, the cash compensation must be reduced by at least enough to cover the cost of providing the NMIs. If the service members value these NMIs more than the DoD's cost to provide them, the total value delivered to service members exceeds the DoD's cost of delivery.

The main difficulty when designing a universal incentive package is determining which NMIs to include. With a universal incentive package, all service members desiring an NMI will receive it. The DoD should restrict its NMI offerings to those incentives where the total value captured by the service members exceeds the total cost incurred by the DoD. Graphically, the entire area under the service members' demand curve depicts the total value accruing to the service members; the total area under the DoD's cost curve depicts the total cost to the DoD. There is a potential for significant cost to the DoD in offering optional incentives whose cost exceeds the majority of service members' values.

Figure 2 illustrates the service members' total NMI value and the DoD's total NMI cost. The service members' total value is represented by areas A and B in Figure 2, or the area under the service members' demand curve. The DoD's total cost is represented by areas B and C in Figure 2, or the area under the DoD cost curve. Both value and cost share area B. Clearly, the service members' total value exceeds the DoD's total cost if area A, where service members' value exceeds the DoD's cost, is larger than area C, where the DoD's cost exceeds service members' value; the DoD's cost exceeds the service members' total value if area C is larger than area A. Therefore, in designing a universal NMI package, the DoD should consider including only those NMIs where area A is larger than area C.

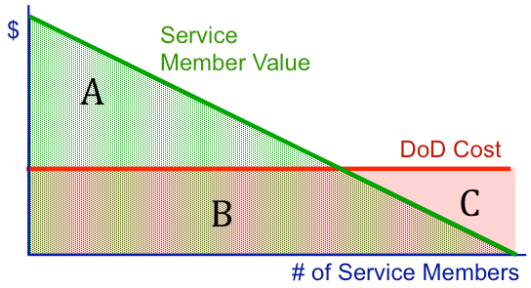

Figure 2. NMI Total Service Member Value and DoD Cost

B. THE INEFFICIENCY OF ONE-SIZE-FITS-ALL INCENTIVES

Figure 3 shows hypothetical value and cost curves for four potential NMIs: geographic stability for three consecutive tours, choice of assignments, a two-year sabbatical, and telecommuting one day per week (assume all four NMIs are operationally feasible). In this hypothetical case, it is most efficient to offer geographic stability and assignment choice in a universal incentive package. Total service member value exceeds total DoD cost for both of these NMIs. Sabbaticals and telecommuting, however, would result in a net deficit if included in a universal NMI package, because total service member value is less than total DoD cost. In this hypothetical example, geographic stability and assignment choice would be candidates for a universal incentive package; sabbaticals and telecommuting would not.

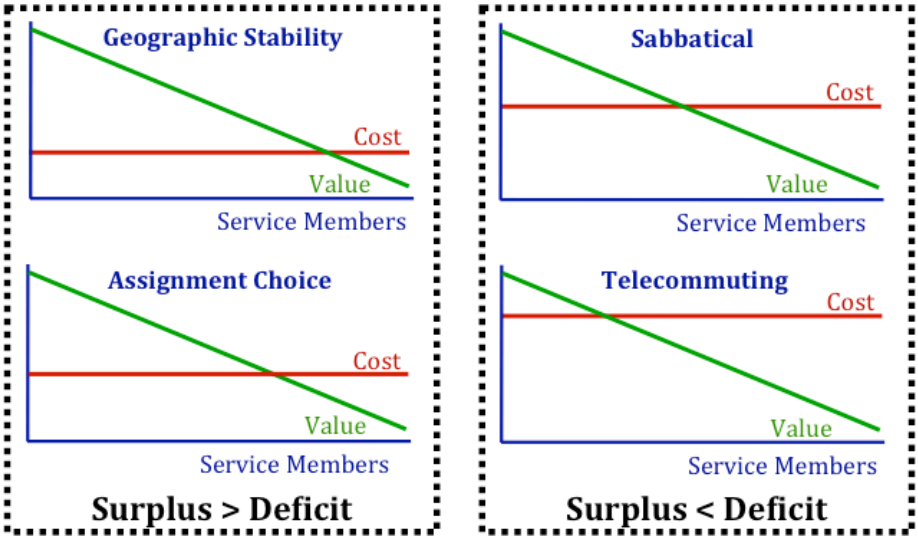

Figure 3. Non-Monetary Incentives Portfolio

Looking more closely at the net surplus and net deficit areas in Figure 3, as depicted in Figure 4, highlights one limitation associated with a universal incentive package. As described previously, offering geographic stability and assignment choice as a part of a universal incentive package adds non-monetary compensation where the service members' surplus value exceeds the DoD's costs, potentially reducing the DoD's compensation costs. However, some service members who receive geographic stability and assignment choice place a lower value on these incentives than the DoD's cost to

provide them.[3] It would be much more efficient to limit geographic stability and assignment choice to those service members for whom value exceeds cost. Doing so would eliminate the potential inefficiency and waste associated with these incentives.

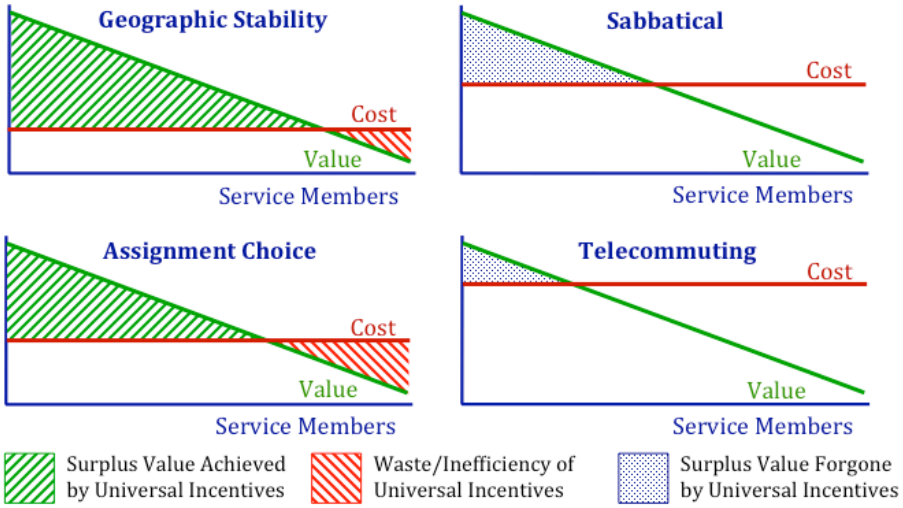

Figure 4. Limitations of a Universal Incentive Package

Furthermore, while it would not make sense to offer sabbaticals and telecommuting as part of a universal incentive package, because the DoD's total costs exceed the service members' total value, some service members may derive value from these incentives that greatly exceeds the DoD's costs as depicted in Figure 4. The DoD may lose the opportunity to exploit some significant potential savings by not offering these incentives to those who value them highly.

In summary, incorporating a universal non-monetary incentives package as part of the DoD's compensation scheme can potentially reduce the DoD's total compensation costs. To do so requires identifying those incentives where the DoD's cost is less than the value to the service member. However, providing all service members with a common incentive package is inefficient and wasteful to the extent that some service members value the incentive less than it costs the DoD; a universal incentive package also fails to exploit the potential efficiencies that could be captured by offering the excluded incentives to service members who value them highly.[4]

[3] The specific non-monetary incentives included here are simply offered as illustrations; the DoD's cost to provide these incentives is not specifically addressed. Briefly, it may appear that the DoD could provide some incentives, such as geographic stability and assignment choice, at little or no cost. However, providing incentives such as these reduces the DoD's flexibility to match service members and job assignments. Offering one service member geographic stability may trigger higher moving costs for some other service member, or may force the DoD into assignments with less qualified service members, etc. Losses in flexibility can be expected to increase the DoD's costs or reduce assignment effectiveness.

[4] For further discussion, see Coughlan et al. (2011, pp. 72–79) and Zimmerman (2008, pp. 77–84).

III. VARIABILITY IN NON-MONETARY INCENTIVES VALUATIONS

The preceding discussion indicates that a universal incentives package can be effective if there is consistency across service members' incentive valuations; variable preferences would indicate that the DoD should offer more personalized incentive packages tailored to each service member's individual preferences. The critical question concerns consistency in service member NMI preferences.

There are at least three forms of variability limiting effectiveness in a universal incentive package (Ellis, 2009): variability across population classes, variability across individuals within a population, and variability across individual NMI values within different incentive packages. Variability across population classes (e.g., across Services, professional communities, rank/pay grade, etc.) recognizes that preferences may vary across identifiable groups of service members (e.g., child care may be more valuable to service member populations more likely to have young children). Variability across individuals within a population class recognizes that people in similar circumstances may still have different preferences (e.g., not all service members have children and need child care, even in the populations more likely to have children). Finally, variability across NMI packages for a particular individual recognizes that values for individual NMIs may depend on the portfolio of NMIs offered (e.g., a service member might place a high value on either child care or geographic location—perhaps to be close to family-provided child care—but could have little extra value for both over one or the other). All three sources of variation in NMI valuations reduce the effectiveness of universal incentives packages.

To explore variability in NMI valuation within the U.S. Navy, two surveys were administered to one officer and two enlisted communities: the junior surface warfare officer (SWO) community, and the air traffic controller and fire controlman enlisted communities. Both surveys asked the respondents to indicate the reenlistment or retention bonus they would require to continue their military service; respondents were then asked how much of this bonus they would willingly sacrifice to receive a specific NMI or combination of NMIs. Some NMIs were included in both surveys, but some NMIs were specific to the officer or enlisted communities, reflecting differences in their career status and related preferences.

Surface warfare is the Navy community that uses surface ships for the missions of forward naval presence, sea control, and projection of power ashore. The surface warfare community is the oldest community in the Navy and includes approximately 8,000 officers (Graham, 2006). SWOs are the fleet's "ship drivers" that operate surface ships at sea, including managing all the onboard systems and personnel. It is their job to lead the ship into harm's way when so directed by higher authority.

The Navy's primary concern with the surface warfare officer community is how to retain the necessary quality and quantity of officers past their initial obligations to ensure there are sufficient SWOs to fill the existing department head jobs across the fleet. Upon

reaching the end of their initial obligated service period, junior SWOs must make critical career decisions on whether to stay in the Navy or look for a career in the civilian sector. Many decide to get out of the Navy at this point, others may try to laterally transfer to another community, and some decide to continue in their SWO career path.

The SWO survey (Denmond et al., 2007) targeted those junior surface warfare officers nearing the end of their initial obligated service who had not yet signed a contract accepting a retention bonus or submitted a request for resignation from active duty. The survey was distributed, collected, and completed anonymously.[5] There were 260 completed surveys. Of these, 105 respondents reported that there was no amount of money that would induce them to remain; another 11 responses specified required retention bonuses exceeding the current federal Title IX cap, most over seven figures. These responses were excluded from the analysis, leaving 144 usable responses.

The air traffic controller (AC) and fire controlman (FC) ratings were selected based on each community's size and retention challenges. The Department of the Navy identified these ratings as two of the 20 "most undermanned critical skills" (DoN, 2008). Navy ACs have responsibilities similar to civilian air traffic controllers, and they support Naval airpower in both operational and training environments. FCs operate, maintain, and repair weapons system electro-mechanical support equipment (fire control radars, mainframe computers, large-screen displays, LANS, weapon control consoles, etc.). The AC and FC ratings are comparable with respect to initial service obligation length, intensity of training, and quantity of civilian employment opportunities.[6]

The AC and FC surveys (Zimmerman, 2008) were targeted for service members at the rank of Petty Officer First Class (E-6) and below, though some surveys were returned from more senior enlisted ranks. There were 688 surveys completed; however, only 604 responses were usable. The deleted responses were missing crucial data that could not be inferred from the other available information.

A. VARIABILITY ACROSS POPULATIONS: OFFICERS (SWOS) VERSUS ENLISTED (AC/FC)

One complication in selecting non-monetary incentives, particularly for a universal incentive package, involves variability in preferences across different populations: by rank and years of service, by community, etc. It is difficult to identify a universal incentive package that would adequately motivate all groups if the values for incentives vary across populations.

[5] See Denmond et al. (2007) for a detailed description of the survey methodology; Coughlan et al. (2011) provide a summary description. Denmond et al. (2007) provide a detailed discussion of the survey response rate. The discussion here does not presume that the NMI values derived from the survey are necessarily accurate in absolute terms. However, we expect that the survey results accurately portray the relative variability in SWO NMI preferences.

[6] See Zimmerman (2008) for a detailed description of the survey methodology; Coughlan et al. (2011) provide a summary description. Zimmerman provides a detailed discussion of the survey response rate. The same conclusion holds that the survey results accurately portray the relative variability in NMI preferences for ACs and FCs.

To illustrate, the SWO and enlisted surveys both included questions regarding the service members' valuation of the following incentives: choice of homeport; choice of platform/ship type; and choice of billet, a one-year sabbatical, telecommuting, and geographic stability for two tours. Figure 5 shows the difference in average valuation for these NMIs. The valuations listed are the average amount of cash the respondent would sacrifice to obtain the indicated incentives; these values are also expressed as a percent of the average required selective retention bonus (SRB).[7] For reference, the standard error bars are shown for each NMI in Figure 5.

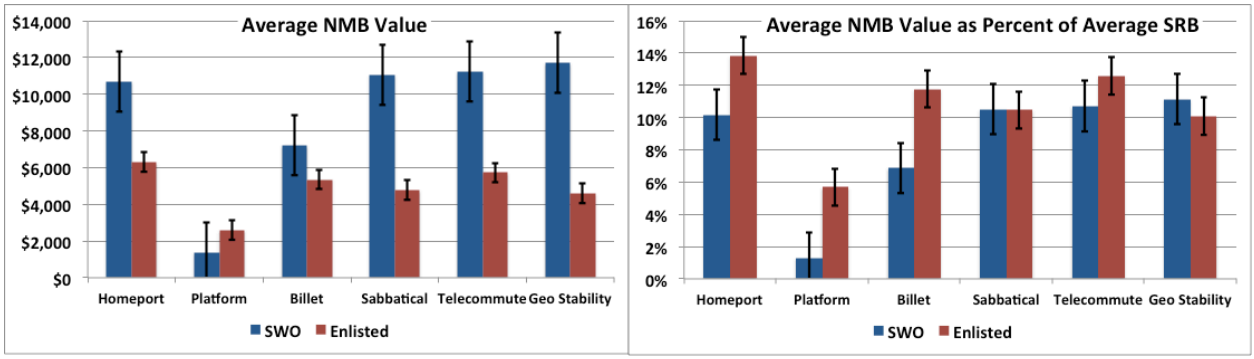

Figure 5. Average NMI Values

On average, the officer respondents place the highest value on geographic stability, followed by telecommuting and a one-year sabbatical. The enlisted respondents place the highest value on homeport of choice, followed by telecommuting and choice of billet. While the average dollar values of NMI are generally higher for the SWO respondents, this largely reflects their higher average SRB requirement. The enlisted respondents expressed higher average NMI values as a percentage of the average required SRB. Figure 5 demonstrates that different groups value non-monetary incentives differently. This introduces a layer of uncertainty that is important to consider in designing compensation schemes, including NMIs.

B. VARIABILITY ACROSS INDIVIDUALS WITHIN A POPULATION

The variability in the valuation of non-monetary incentives across populations is further complicated by variability in the valuation of NMIs among members within the same population. When selecting NMIs to include as part of a compensation package, the DoD should restrict its NMI offerings to those incentives where the value captured by the service members exceeds the cost incurred by the DoD. While Figure 5 shows there are some NMIs that have relatively high average values, both in absolute terms and as a percent of the required SRB, average values disguise the variability in values across individuals within a community.

For example, consider the value of telecommuting as expressed by the respondents in both the SWO and enlisted surveys. Telecommuting had the second highest value, for both populations, of the six incentives included in both surveys. Figures 6 and 7 show

[7] The bonus paid to service members in exchange of additional years of service.

the values as a percent of the respondents for the SWOs and enlisted surveys, respectively. These figures demonstrate that using the mean value to reflect incentive valuations can be misleading. In both surveys, many of the value distributions for the non-monetary incentives have large clusters at zero dollars, smaller clusters at certain "focal" values, and long right-hand tails with a few high values.

While the SWOs' mean value for telecommuting is $11,214, the median value is only $1,000; 42% of the SWO respondents indicated that they would not reduce their required SRB by even $1.00 if offered the opportunity to telecommute. In the enlisted survey, the mean value for telecommuting was $5,862, while the median value was only $1.00; 47% of the enlisted respondents indicated that they would not reduce their required SRB by even $1.00 if offered the opportunity to telecommute.

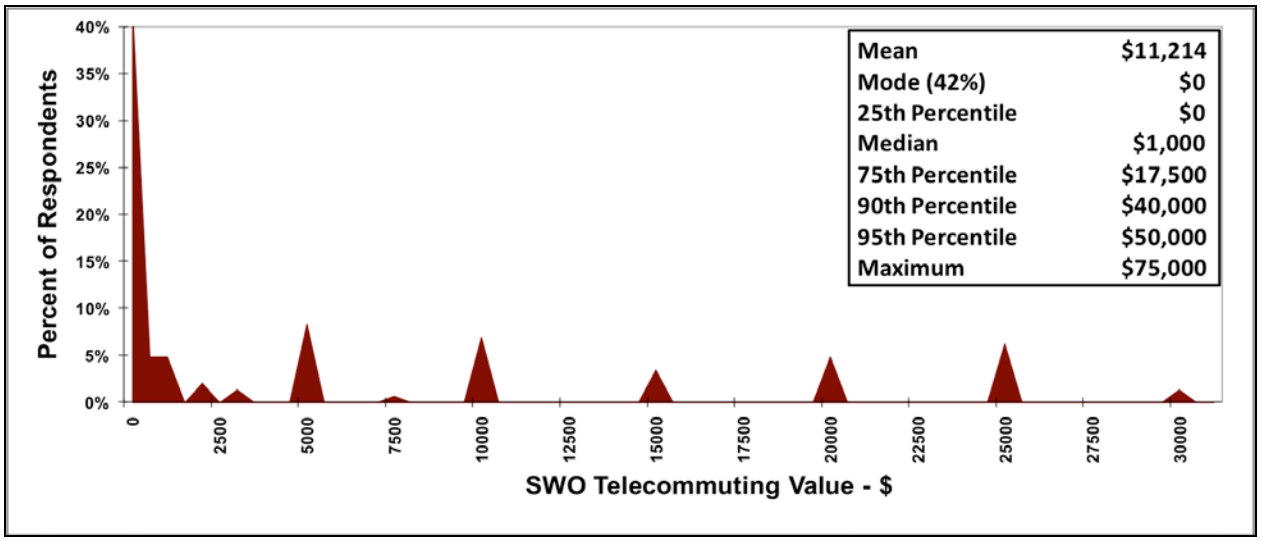

Figure 6. SWO Telecommuting Value Distribution

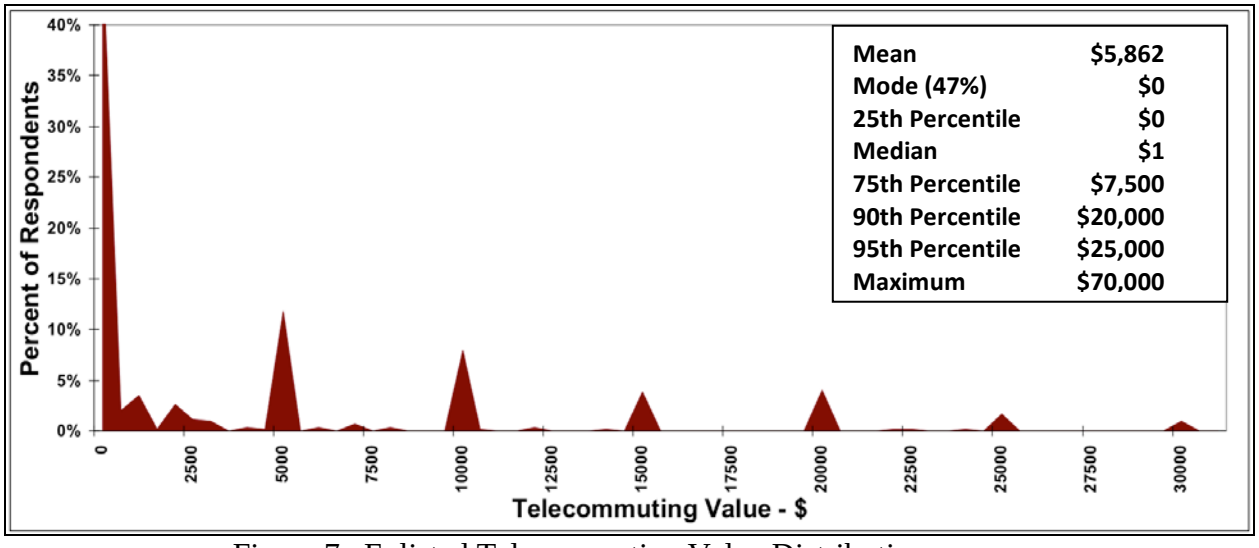

Figure 7. Enlisted Telecommuting Value Distribution

Tables 2 and 3 display the 10th, 25th, 50th, 75th, and 90th percentile values for the NMIs included in both the SWO and enlisted surveys, respectively, to more accurately describe the value distribution for each incentive.[8]

Table 2. SWO Non-Monetary Incentive Value Percentages

	Percentile							
	Mean	10th	25th	50th	75th	90th	95th	Max
SRB Required	$105,007	$50,000	$75,000	$100,000	$150,000	$150,000	$200,000	$200,000
Homeport of Choice	$10,617	$0	$0	$5,000	$15,000	$25,000	$50,000	$75,000
Platform of Choice	$3,603	$0	$0	$0	$5,000	$10,000	$15,000	$50,000
Billet of Choice	$7,159	$0	$0	$1,000	$10,000	$20,000	$25,000	$70,000
One-Year Sabbatical	$10,921	$0	$0	$0	$20,000	$34,000	$50,000	$100,000
Telecommuting	$11,214	$0	$0	$1,000	$17,500	$40,000	$50,000	$75,000
Geographic Stability (2 tours)	$11,595	$0	$0	$5,000	$20,000	$30,000	$50,000	$75,000

Table 3. Enlisted Non-Monetary Incentive Value Percentiles

	Percentile							
	Mean	10th	25th	50th	75th	90th	95th	Max
SRB Required	$47,948	$10,000	$25,000	$45,000	$70,000	$89,000	$100,000	$350,000
Homeport of Choice	$6,358	$0	$0	$5,000	$10,000	$20,000	$25,000	$50,000
Platform of Choice	$2,563	$0	$0	$0	$2,100	$10,000	$10,000	$50,000
Billet of Choice	$5,357	$0	$0	$2,000	$10,000	$15,000	$20,000	$51,500
One-Year Sabbatical	$4,706	$0	$0	$0	$5,000	$15,000	$25,000	$65,000
Telecommuting	$5,862	$0	$0	$1	$7,500	$20,000	$25,000	$70,000
Geographic Stability (2 tours)	$4,609	$0	$0	$0	$5,000	$12,800	$20,000	$50,000

One striking characteristic revealed in Tables 2 and 3 is that both the 10th and 25th percentiles for the distribution of reported values for all six NMIs is zero. This means that at least 25% of all respondents saw no value for any NMI included here. Furthermore, 50% of the SWOs reported no more than a $1.00 value for two of the six NMIs analyzed across both surveys; 50% of the enlisted respondents reported no more than a $1.00 value for four of the six common NMIs. However, 5% of the respondents expressed values for these common NMIs ranging from $15,000 to $50,000 for the SWO survey, and between $10,000 and $25,000 for the enlisted survey. The maximum values range from $50,000 to $100,000 for the SWO survey, and between $50,000 and over $70,000 in the enlisted survey (Coughlan et al., 2011).

From Tables 2 and 3, there are few NMIs that have significant positive values for at least 50% of the force, and some of the NMIs included in both surveys have relative low mean values. Furthermore, the distributions of values vary across populations (the SWO and enlisted surveys in this case). This demonstrates the difficulty the military would face in selecting one or more NMIs that should be universally offered to the entire force. Furthermore, at least 25% of the population placed a significant value on each NMI, and over 10% of the population expressed values of $10,000 or more on every one of the six NMIs reported here. Most of these NMIs would be reasonably inexpensive to provide, particularly to the small subset of service members receiving the greatest value. There is

[8] Coughlan et al. (2011) provides the distribution information for all NMIs included in both the SWO and enlisted surveys. The distributions for the NMIs excluded from this discussion are similar to those discussed here.

clearly value to be gained by offering individualized NMI packages, concentrating specific NMIs on those service members receiving the greatest value.

As a final consideration, Figure 8 shows the distribution of the maximum value for any single NMI reported by participants across both the SWO and enlisted service member populations. In particular, the graph shows the percent of the population reporting a value that is at least equal to the x-axis value. While few individual NMIs have positive values for over 50% of the respondents, only 18% of the sample reported a zero value for all six NMIs. Over 50% of the sample reported a value of $10,000 or more for at least one NMI, and 25% of the sample reported a value of at least $20,000. While it may be difficult to find a single NMI or NMI package that appeals to a large portion of the force, a large percent of the force would derive significant value from the NMI that best meets their needs. The DoD can reduce its costs and increase service member values if the right NMIs are provided to the right service members, and if providing those NMIs involves reductions in other monetary compensation. However, this discussion emphasizes that NMIs must be tailored to the service members' individual preferences.

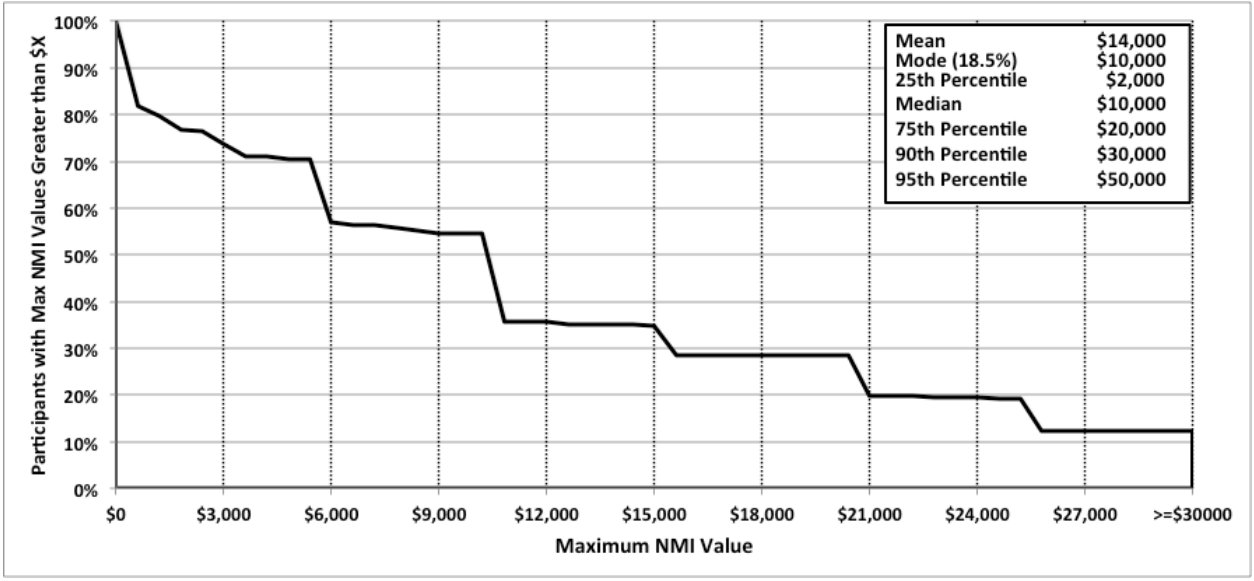

Figure 8. Maximum NMI Values for All Respondents

C. VARIABILITY ACROSS COMBINATIONS OF NON-MONETARY INCENTIVES

Another complicating factor to introducing NMI compensation packages arises when NMIs are offered in combination. Service members may value a combination of NMIs more or less than the sum of their individual values. In other words, service members will view some combinations of NMIs as complements, others as substitutes, and still others as largely independent. When offered together, the value of complementary NMIs will exceed the sum of their individual values (the NMI values are superadditive) because they are more desirable in combination than they are when offered independently. Conversely, multiple NMIs offered together may have lower value in combination than the sum of their individual values (subadditive). For example, subadditivity may occur when the NMIs are considered to be substitutes and at least partially satisfy the same

desires. Finally, independent NMIs will have the same values whether offered alone or in combination (additive), because their values are not related to one another.[9] Correlation in NMI values presents an additional variability that complicates an NMI compensation policy, particularly if the patterns of superadditive, subadditive, and additive preferences differ across individual service members. As the number of NMIs offered increases, it also increases the probability of variability across individuals due to correlated values.

Table 4 illustrates the concepts of additive, superadditive, and subadditive values for combinations of NMIs. The Additivity Differential (AD) shows the amount by which the value of the NMI combination exceeds, or falls short of, the summed values of the individual NMIs; AD is positive for superadditive combinations, negative for subadditive combinations, and zero for additive combinations. Mathematically,

$$AD = \text{Value}(A + B) - [\text{Value}(A) + \text{Value}(B)]. \quad (1)$$

Table 4. Additive, Subadditive, and Superadditive NMI Values

Category	Individual NMI Values		Homeport and Geographic Stability in Combination	Additivity Differential
	Homeport	Geographic Stability		
Additive	$8,000	$12,000	$20,000	$0
Superadditive	$8,000	$12,000	$25,000	$5,000
Subadditive	$8,000	$12,000	$16,000	-$4,000

Both the surface warfare officer study and the enlisted retention study elicited values for combinations of NMIs from the respondents. In the SWO study, respondents were asked to value all possible combinations of three different NMIs: homeport and billet of choice; homeport and platform of choice; platform and billet of choice; and homeport, platform, and billet of choice. In the enlisted survey, respondents were asked to value the possible combinations of two different sets of three NMIs, including the three possible two-way parings and the three-way combination. The NMI combinations examined in the enlisted survey included homeport of choice, geographic stability, and a compressed workweek (longer hours four days per week with a bi-weekly three-day weekend), as well as homeport of choice, telecommuting, and a lump-sum retention bonus (as opposed to a retention bonus paid annually over the additional service commitment).

Table 5 summarizes the percentage of respondents with additive, superadditive, and subadditive preferences for the various NMI combinations in the two surveys. Additive preferences were the mode in all cases in the SWO survey; subadditive preferences were more prevalent in all two-way SWO combinations, while superadditive preferences were slightly more prevalent for the three-way SWO combination. Subadditive preferences were the mode in all but one case in the enlisted survey. Superadditive preferences were the least prevalent for all enlisted preferences, and generally less common than for the

[9] The notion of additivity, superadditivity, and subadditivity for the NMIs are much more general than independence, complements, and substitutes. We will limit our focus to independence, complements, and substitutes for this article.

SWO respondents. Thus, respondents expressed values for NMI combinations falling into all three possible outcomes: additive, superadditive, and subadditive.

Table 6 shows the average AD for each NMI package in both sample sets, and the average AD for those expressing superadditive and subadditive preferences. The standard deviations are provided in the parentheses. Recall that the AD is equal to zero when NMI values are purely additive. The AD is positive for superadditive preferences and negative for subadditive preferences.

Table 5. Additive, Superadditive, and Subadditive Preferences (%)

SWO	Additive	Super-additive	Sub-additive
Homeport & Billet Choice	49%	15%	36%
Homeport & Platform Choice	55%	15%	31%
Billet & Platform Choice	58%	9%	33%
Homeport, Billet and Platform Choice	38%	33%	29%

Enlisted	Additive	Super-additive	Sub-additive
Homeport Choice & Geographic Stability	40%	8%	52%
Homeport Choice & Compressed Workweek	38%	6%	56%
Geographic Stability & Compressed Workweek	49%	8%	43%
Homeport Choice, Geographic Stability, & Compressed Workweek	31%	12%	57%
Lump Sum SRB & Telecommuting	47%	6%	48%
Lump Sum SRB & Homeport Choice	39%	9%	52%
Telecommuting & Homeport Choice	35%	3%	62%
Lump Sum SRB, Telecommuting, & Homeport Choice	30%	8%	62%

Table 6 illustrates that the average ADs are less than zero for all but the three-way SWO combination, though the differences are small, less than $3,000, and none are significantly different than zero, which would indicate pure additivity. However, just looking at the average ADs understates the diversity of preferences. Some respondents have strongly superadditive preferences, while others have strongly subadditive preferences. The average AD for superadditive preferences falls between $7,000 and $15,000; the average AD for subadditive preferences ranges from -$11,000 to -$13,000.

The average AD is more negative for the enlisted respondents, ranging from -$3,000 to -$10,000. The average AD for subadditive preferences ranges between -$8,500 to almost -$17,000, indicating that these respondents viewed the NMI packages as combining incentives with overlapping values. The enlisted respondents seem much more likely than SWOs to have subadditive preferences, both in frequency (Table 5) and in magnitude (Table 6).

Table 6. Average Overall, Superadditive, and Subadditive Additivity Differentials

SWO	Average	Super-additive	Sub-additive
Homeport & Billet Choice	-$2,077 (12,386)	$12,333 (16,247)	-$10,692 (12,304)
Homeport & Platform Choice	-$1,856 (10,883)	$9,786 (13,948)	-$10,702 (11,960)
Billet & Platform Choice	-$3,002 (10,195)	$6,916 (9,201)	-$11,046 (13,602)
Homeport, Billet & Platform Choice	$1,169 (16,403)	$14,851 (15,739)	-$12,949 (15,451)

Enlisted	Average	Super-additive	Sub-additive
Homeport Choice & Geographic Stability	-$4,682 (9,525)	$5,158 (3,882)	-$9,779 (10,714)
Homeport Choice & Compressed Workweek	-$4,770 (8,749)	$5,622 (6,536)	-$9,002 (9,298)
Geographic Stability & Compressed Workweek	-$3,197 (8,071)	$6,421 (8,033)	-$8,656 (8,964)
Homeport Choice, Geographic Stability, & Compressed Workweek	-$6,130 (13,073)	$6,783 (7,380)	-$12,096 (14,064)
Lump Sum SRB & Telecommuting	-$5,916 (24,109)	$9,387 (21,879)	-$13,490 (32,227)
Lump Sum SRB & Homeport Choice	-$4,865 (11,726)	$6,874 (8,044)	-$10,514 (13,382)
Telecommuting & Homeport Choice	-$7,994 (27,131)	$8,235 (5,587)	-$13,313 (33,332)
Lump Sum SRB, Telecommuting, & Homeport Choice	-$9,993 (28,833)	$5,260 (3,798)	-$16,767 (34,849)

To summarize, there are at least three sources of variation in preferences for NMIs: variability across population classes, variability across individuals within a population, and variability across individual NMI values within different incentive packages. All sources of variation make it virtually impossible to select an individual NMI that will add significant value to even half of the military service member population. This becomes even more difficult when creating packages of NMIs. For some, receiving the NMIs in combination may significantly increase the value over the NMIs in isolation; the combination may significantly decrease the value for others. Rather than centrally selecting a universal set of NMIs, it would be much more effective to allow service members to select their preferred incentive or combination of incentives, as long as there is a cost associated with each NMI chosen, and the cost presumably reflects the actual cost to provide the NMI.

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IV. CHOICE IN MILITARY FORCE PLANNING

There is ample evidence in the literature emphasizing the value of personalized employee compensation packages. Ballentine (2003) noted that non-monetary incentives need to be tailored to the individual worker because preferences differ by age, needs, and career stage. Younger workers seek satisfaction through the workplace environment, while older workers are more concerned with their transition to retirement, including part-time and temporary work opportunities. Berry (2005), Cohen (2006), Dolan (1996), Hemsley (2004), and Simms (2007) are among those finding that personalized non-monetary incentives are cost-effective components of a compensation package and contribute to employee morale, performance, and retention.

As noted by Ehrenberg and Smith (2009), personalized NMIs improve employee satisfaction; more satisfied employees are easier to retain and require fewer monetary incentives. Tremblay, Sire, & Pelchat (1998) found evidence to support the theory that flexible benefit plans improve employee satisfaction. Jenkins and Lawler (1981) demonstrated that participation in pay plan development yields positive results. Similarly, Lawler and Hackman (1969) showed that participation in developing and implementing a plan may have a greater impact on the plan's effectiveness than the mechanics of the plan itself. Van Boening, Blackstone, McKee, and Rutstrom (2006) suggested that the mere presence of a choice is itself a benefit and that flexible benefits packages may be strongly preferred to pre-defined benefits packages.

This research reveals the tremendous potential of flexible benefits packages. However, three caveats are noted: to make an informed decision, employees must be fully informed about the entirety of their compensation package (Hattiangadi, 2001); they must be able to choose between the potentially complex options offered (Van Boening et al., 2006); and personalized benefit packages may create a sense of competition between employees, as opposed to a sense of team cooperation (Ballentine, 2003).

A. CHOICE IN MILITARY FORCE SHAPING

The preceding discussion illustrates the diversity of service member preferences across NMIs and the potential value associated with personalized incentive packages in military compensation. These findings are consistent with the general literature on employee choice. They are also consistent with past experience in military force shaping and service member job assignments.

One example of choice in military force shaping involves the military drawdown in the early 1990s. The National Defense Authorization Act for Fiscal Year1991 directed the DoD to reduce the active duty force by 400,000, or 25% (Congressional Budget Office [CBO], 1999; Warner & Pleeter, 2001). This was met by reducing accession, but also required separating mid-career service members before they reached 20 years of service and became vested in the military retirement system. The DoD worried that involuntarily separating mid-career service members would seriously reduce morale in the all-volunteer force. To assist with this transition, the DoD proposed offering an annuity,

called the Voluntary Separation Incentive (VSI), to service members voluntarily separating from the military. Congress added a lump-sum option, called the Selective Separation Bonus (SSB).

Both the VSI and SSB were approved in the National Defense Authorization Act for Fiscal year 1992/1993 for service members with six to 20 years of service. The VSI provided separating service members an annuity equal to 2.5% of annual base pay multiplied by the service member's years of service; the annuity payments continued for a period equal to twice the service members' years of service. The SSB offered a lump sum payment on separation equal to 15% of annual base pay multiplied by the service member's years of service.

While the VSI and SSB were effective for more junior service members, they were less effective for those nearing 20 years of service and retirement vesting. As a result, the National Defense Authorization Act for Fiscal Year 1993 added a third voluntary separation incentive, called the Temporary Early Retirement Authority (TERA), for service members with between 15 and 20 years of service (CBO, 1999). TERA offered retirement benefits similar to the regular military retirement system, but discounted the retirement annuity for service members with between 15 and 20 years of service. The regular annual retirement annuity effectively increases by 2.5% per year, reaching 50% after 20 years of service. Service members separating under TERA received 95% of the regularly accrued annuity at 15 years of service, increasing linearly to 100% at 20 years of service; the associated annuity ranged from 35.625% to 50% for 15 to 20 years of service.

As a result, service members between six and 20 years of service faced two to three options for voluntary separation: VSI, SSB, and TERA (for those with at least 15 years of service). Data from the Defense Manpower Data Center summarize the separation program choices for service members voluntarily separating during the years that VSI, SSB, and TERA were offered. Figures 9 and 10 show the number of enlisted service members and officers separating under each program, respectively, by years of service.

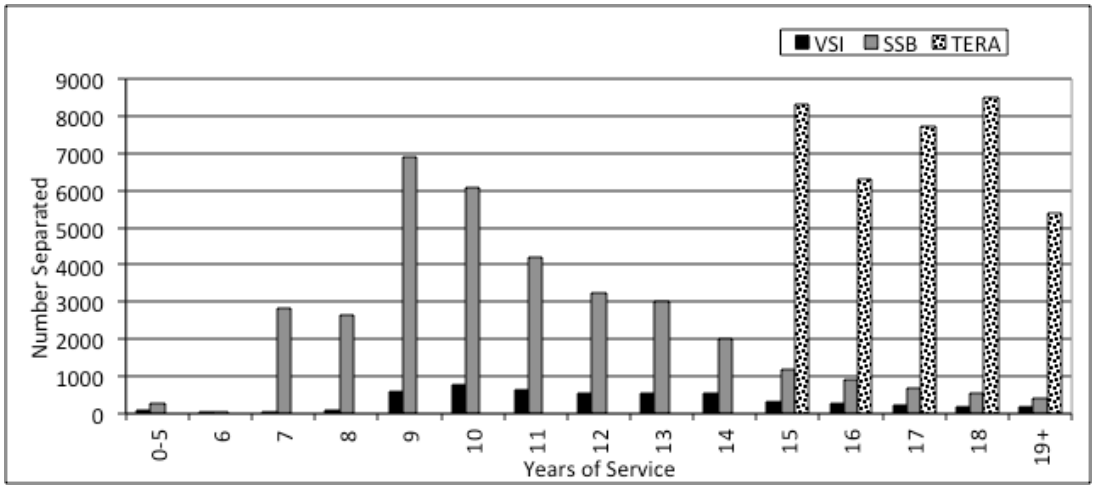

Figure 9. Enlisted Voluntary Separations Under VSI, SSB, and TERA (1992–1997)

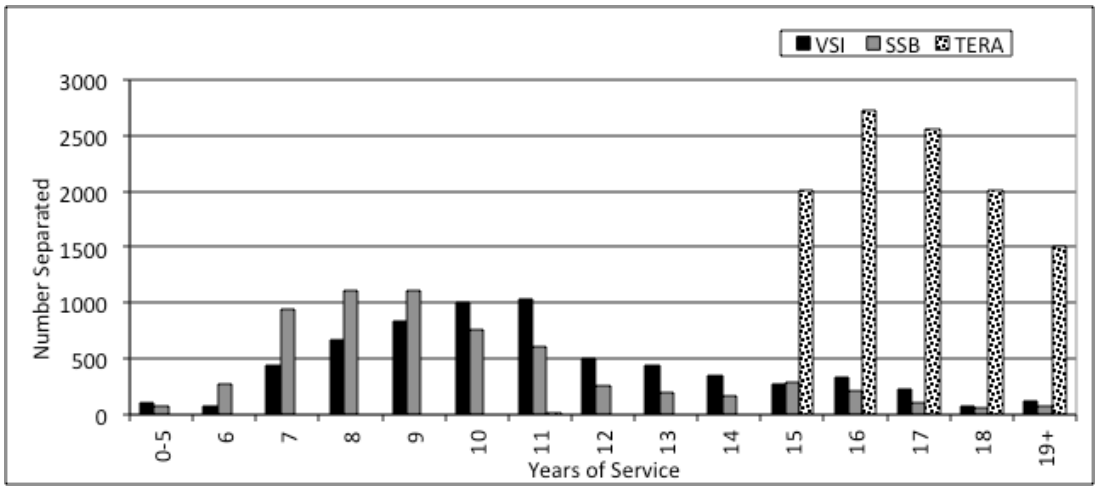

Figure 10. Officer Voluntary Separations Under VSI, SSB, and TERA (1992–1997)

As Figures 9 and 10 demonstrate, TERA, which offers a lifetime annuity, is clearly the dominant choice over SSB and VSI for TERA-eligible service members. For service members with between six and 15 years of service, the comparison is more complicated. Enlisted service members strongly preferred SSB to VSI for all service tenures between six and 15 years of service, though the relative preference for VSI increased with years of service. Officers with fewer than 10 years of service preferred SSB to VSI, while VSI dominated for officers with over 10 years of service.

The choice between VSI and SSB reflects a selection between an up-front lump-sum payment and an annuity paid over a number of years. Preferences between these options depend heavily on personal discount rates, or the individuals' relative preference for payments now versus payments in the future. As personal discount rates increase, indicating that service members have an increasing preference for current payments, SSB becomes more attractive relative to VSI. The breakeven discount rate can be calculated by determining the rate at which the present value of the VSI annuity is equal to the lump-sum SSB payment. The results of this calculation are depicted in Figure 11. The breakeven discount rate increases with years of service, which explains why the relative preference for VSI increased with years of service for separating service members in Figures 9 and 10.[10]

[10] Similar breakeven discount rates were calculated for TERA and both VSI and SSB. The breakeven discount rates between TERA and SSB are almost identical, though slightly higher, to the breakeven rates between VSI and SSB; the difference is largely indistinguishable on the graph in Figure 11 and is not shown here. There is only a very narrow range of discount rates where VSI is preferred to both TERA and SSB, again not distinguishable in Figure 11.

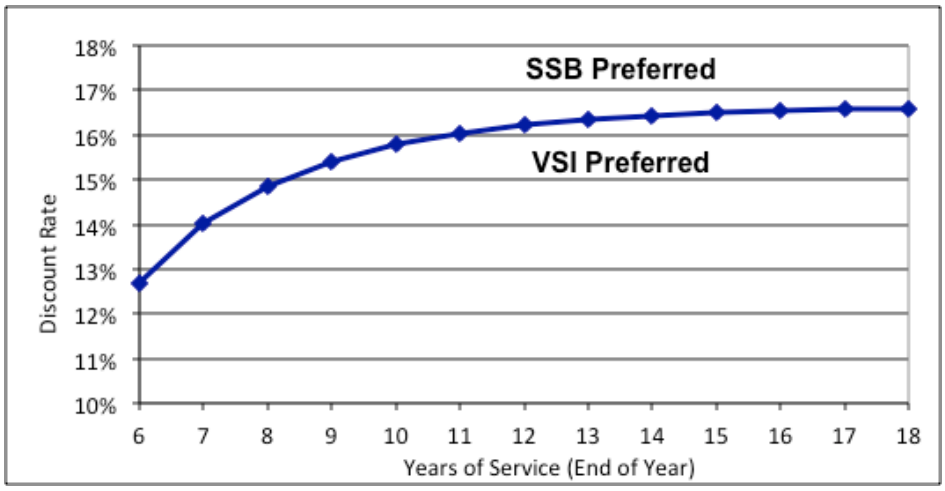

Figure 11. Breakeven Discount Rates: VSI Versus SSB

Clearly personal discount rates vary across service members. Consequently, preferences will also vary between an up-front lump-sum payment and an annuity paid over several years. Service members were better served during the 1990s military drawdown when they faced a choice of separation incentives and selected incentives based on their personal preference. Revealed relative preferences differed between officers and enlisted personnel, and across years of service for both groups. Had the DoD only offered VSI, as originally planned, it would have been to the detriment of enlisted personnel and all service members with fewer years of service.

B. CHOICE IN NAVY ENLISTED ASSIGNMENTS

The military personnel system reassigns service members to different jobs every two to three years. Different Services conduct the assignment process in different ways, but the Navy's enlisted detailing process is a labor intensive process in which human "detailers" attempt to match sailors to billets (jobs), considering Navy priorities (readiness, skill, and career enhancement), command priorities (appropriate training, timing, and past performance) and sailor preferences (job, location, etc.). The assignment process details over 100,000 sailors per year, with the expressed goal to ensure the four rights: the right sailor, with the right training, in the right billet, at the right time.[11]

In the early 2000s, there was increasing evidence that enlisted sailors were dissatisfied with the Navy's detailing process, reducing morale and retention (Short, 2000). Sailors often felt that their preferences were undervalued relative to Navy needs. Short (2000) reported that 47% of Navy enlisted personnel were dissatisfied with the detailing process, with the junior enlisted ranks more likely to leave military service due to unsatisfactory experiences with the detailing process. Dissatisfaction was particularly acute for sailors "slammed" into perennially difficult-to-fill jobs that were consistently avoided by enlisted sailors.

In June 2003, the Navy introduced Assignment Incentive Pay (AIP) to reduce the recurrent shortages and dissatisfaction created by slamming sailors into consistently hard-

[11] The Navy's assignment process is described in more detail by Short (2000).

to-fill billets (Chief of Naval Operations, 2004). The Navy designates the billets that are AIP eligible, and sets a maximum monetary incentive for each billet. Sailors interested in an AIP-eligible billet submit private bids (unknown to other bidders), in $50 increments, specifying the minimum incentive pay required to "voluntarily" fill that position. Bids can start at $0, but cannot exceed the Navy-specified maximum selected for that particular assignment. Using a modified sealed-bid, first-price reverse auction, the Navy selects the "lowest-total-cost" qualified sailor to fill the billet, where total-cost includes the sailor's AIP bid plus any applicable training and moving costs for the selected sailor to fill the AIP billet.[12] The Navy's AIP program has become increasingly popular, alleviating chronic personnel shortages in a variety of hard-to-fill billets.

With the AIP program, the Navy recognizes that providing choice to reflect differences in sailors' preferences increases sailor morale and retention. While AIP-eligible billets are generally unpopular, some sailors are more willing (less unwilling) than others to accept those assignments. AIP allows sailors to indicate their preferences and assigns the most willing sailors to the less attractive billets and compensates them so they are indifferent to assignments to more attractive billets. Sailors who are particularly averse to filling the AIP-eligible billets, for whatever personal reason, are not slammed into those assignments as might have occurred prior to AIP.

[12] This is a sealed-bid auction because sailors submit a single bid that is unknown to other bidders. A traditional sealed-bid first-price reverse auction would select the lowest bid and pay the winning sailor the required incentive pay reflected in the winning bid. This is a modified auction because the winning sailor is the lowest total-cost sailor, not the lowest AIP bid. A noted in Tan (2006), this modification affects bidding behavior and the auction results by incentivizing sailors with low moving and training costs to bid above what they would bid in a traditional sealed-bid first-price reverse auction. Tan (2006) tests a two-sided matching mechanism that would eliminate the incentive to misstate one's true preferences.

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V. PERSONALIZED INCENTIVES PACKAGES IN MILITARY COMPENSATION

While the DoD in general and the Navy in particular have experience providing service members with choice in force shaping decisions, including the 1990s defense force drawdown and the Navy's AIP auctions, how can NMIs be used as a retention (or separation) incentive when each NMI is valued very highly by some, but not valued at all by many or most? Retention (or separation) decisions involve a single employer (the military Services) and multiple sellers (the individual service members). As such, this exchange relationship suggests a reverse auction, where sellers can express their individual preferences and the buyer accepts those preferences that are best aligned with military service needs. (Coughlan & Gates, 2010)

One mechanism to implement individualized military compensation incentive packages would use a sealed-bid reverse retention auction, similar to the AIP auctions introduced earlier, which allows service members to submit bids integrating monetary and non-monetary retention incentives. Service members would express their preferences for combinations of both monetary and non-monetary incentives, and the lowest cost qualified bidders would be retained. However, the auction design must recognize that the value of NMI combinations is not generally the sum of the individual NMI values. As described earlier, combination values can be superadditive if the NMIs are complements, or subadditive if the NMIs are substitutes.

One way to design individualized compensation packages is to offer a "cafeteria-style" plan in which service members request a monetary retention incentive and select individual NMIs from a menu of NMIs that are listed along with their associated costs. In other words, service members would select the NMIs to include in their individualized retention packages. After choosing from the available NMIs, service members would then submit cash bids indicating the minimum amount required for reenlistment, given that they would also receive their selected NMIs. The cost listed for any selected NMI would be added to the requested monetary incentive to determine total retention cost (and, thus, their likelihood of being retained). Service members would be best served by selecting only the NMIs they value as much or more than their cost (Coughlan, Gates, & Myung, 2013).

The auction could be implemented as either a first-price or generalized second-price reverse auction. The winning bidders would receive the compensation package outlined in their bid in a first-price auction; the winning bidders would receive a compensation package equal to the first excluded bid in a second-price auction, with the monetary incentive being adjusted as needed. Bidders would bid strategically in a first-price reverse auction, overstating their required monetary compensation; bidders should bid their true minimum retention requirements in a second-price reverse auction. Further research is required to determine the timing for the retention auctions, the NMI list and prices, service member eligibility, and several other auction design details. Properly defining the auction details will be critical to successful implementation.

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VI. CONCLUSIONS

Evidence shows that the incentive value of monetary compensation begins diminishing at some point: at lower cash values for some and higher cash values for others. As monetary incentives diminish in value, non-monetary incentives become relatively more important. However, service member preferences across NMIs are diverse. What is valuable for some has little or no value for others. In fact, surveys across different military communities, ranks, and years of service, show the difficulty of identifying any NMI that has significant value for even 50% of the active duty force. At the same time, approximately 80% of the surveyed service members expressed a significant positive value for at least one NMI.

These results verify that the DoD could reduce the cost of military compensation by relying more heavily on NMIs, where service members value the NMI more than the DoD's costs of provision. However, the key to exploiting this potential is personalizing service members' NMI packages to reflect their individual preferences. Providing an NMI to all service members may increase the DoD's costs much more than it increases the service members' value. For example, Harrison (2012) found that the DoD's cost to provide military retirees with healthcare after age 65, through TRICARE for life, exceeds the value associated with that benefit for over 80% of the service members surveyed. As such, the DoD's cost to provide this "universal" benefit greatly exceeds its value as part of the DoD's military compensation package. The DoD could reduce its compensation costs by restricting this benefit to those retirees whose value exceeds the DoD's costs. Others could be offered additional cash payments or other NMIs that would maintain their total value of compensation at a lower DoD cost.
The DoD has experience offering service members choice in military compensation. Two examples described here include voluntary separation pay during the 1990s military drawdown and the Assignment Incentive Pay that the Navy currently offers to voluntarily fill traditionally hard-to-fill billets. The discussion provided here describes how the DoD might offer personalized incentive packages to reduce the cost of reenlistment and retention bonuses. Similar approaches could be used to reduce the cost of the various special pay used for retention in the aviation, submarine, and surface warfare communities.

We have outlined an approach to implementing personalized non-monetary incentive packages in military compensation through a sealed-bid reverse retention auction, where service members select individual NMIs from a "cafeteria-style" menu of options. This auction design could be modified to accommodate additional DoD preferences, for example, providing a premium to retain higher quality service members (White, 2010; Nowell, 2012; Myung, 2013). Similarly, the auction design could identify those more and less willing to serve, and tailor the retention bonus accordingly, further reducing the DoD's retention costs (Cook, 2008).

As a further opportunity, the DoD is currently studying an alternative to the military retirement system, recognizing that changing retirement would also require adjusting the retention and reenlistment bonuses to retain the desired force mix. Service members'

choices between VSI and SSB during the 1990s demonstrate that personal discount rates vary widely across service members, in addition to variations in preferences for NMIs. Providing choice in retirement plans, as opposed to the current universal plan for all service members, should allow the DoD to significantly reduce the cost of retirement compensation by offering service members the retirement benefits they value most highly. Combining choice in retirement options, with personalized retention incentive packages to meet the DoD's force structure goals, could significantly reduce the DoD's military compensation costs.

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